Underground Injection Control Inventory Information Package

Prepared for

United States Environmental Protection Agency

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Contents

Acronyms and Abbreviations

µg/L	micrograms per liter
$AlCl_3$	aluminum chloride
EPA	U.S. Environmental Protection Agency
DEQ	Department of Environmental Quality
DBP	Disinfection byproduct
HACCP	Hazard Analysis and Critical Control Points
HRSD	Hampton Roads Sanitation District
LPA	Lower zone of the aquifer
MCL	maximum contaminant level
mg/L	milligrams per liter
PAS	Potomac Aquifer System
RO	reverse osmosis
SAT	Soil Aquifer Treatment
SWIFT	Sustainable Water Initiative for Tomorrow
SWIFTRC	SWIFT Research Center
TOC	total organic carbon
UIC	Underground Injection Control
VDH	Virginia Department of Health

SECTION 1

Introduction

1.1 SWIFT Overview

The Hampton Roads Sanitation District (HRSD) Sustainable Water Initiative for Tomorrow (SWIFT) will add multiple advanced water treatment processes to select HRSD wastewater treatment facilities to produce a highly treated water (SWIFT Water) that exceeds drinking water standards and is compatible with the receiving aquifer. Secondary effluent from up to seven of HRSD's existing treatment facilities will be treated at SWIFT facilities and SWIFT Water will be recharged into the Potomac Aquifer System (PAS) to counter depleting aquifer levels. At full-scale, HRSD intends to recharge over 100 million gallons per day of SWIFT Water that will significantly reduce the nutrient load to the sensitive Chesapeake Bay and provide significant benefit to the region by limiting saltwater intrusion, reducing land subsidence, and providing a sustainable source of groundwater, a necessity for continued economic expansion in the region.

The SWIFT Research Center (SWIFTRC) involves a nominal 1 million gallons per day advanced treatment facility and injection well located at the Nansemond Treatment Plant (Suffolk, VA) that will begin production and recharge in spring 2018. The primary purpose of the SWIFTRC is to demonstrate at a meaningful scale that advanced treatment will produce SWIFT Water that meets primary drinking water standards and is compatible with the groundwater chemistry and minerals composing the PAS. HRSD will collect at least 18 months of operational data to inform and optimize the design and construction and to define permitting requirements for the full-scale SWIFT facilities.

1.2 Purpose

1.2.1 Environmental Protection Agency Underground Injection Control Program

SWIFT will be regulated under the Underground Injection Control (UIC) Program. The U.S. Environmental Protection Agency (EPA) has primacy over the UIC Program in Virginia. On June 28, 2016, HRSD received a letter from the EPA regarding the UIC permitting of SWIFT. In the letter, EPA agreed to a tiered approach to UIC Program oversight, extending authorization by rule for the SWIFTRC. This authorization by rule requires that HRSD submit a UIC Inventory of information as follows:

- "results of ongoing pilot advanced wastewater treatment system"
- "an analysis of the injected fluid with the aquifer water quality"
- "construction details of the pilot recharge well"
- "a complete sampling and analysis and reporting plan"
- "a description of the monitoring well network", and
- "a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water".

The purpose of this document, the SWIFT UIC Inventory Information Package, is to provide the information requested by EPA. Each of the requested items is directly addressed in this document with detailed supporting reports included in the following attachments:

- Attachment A, Information Requests (EPA, VDH)
- Attachment B, SWIFT Research Center SWIFT Water Quality Targets
- Attachment C, SWIFT Research Center Aquifer Monitoring and Contingency Plans for Manage Aquifer Recharge

- Attachment D, Geochemical Evaluation and Framework Development for the SWIFT Proposed Managed Aquifer Recharge Program
- Attachment E, Plan for Evaluating SWIFT Soil Aquifer Treatment
- Attachment F, SWIFT Research Center 100% Design Documentation
- Attachment G, SWIFT Research Center HACCP Memorandum
- Attachment H, SWIFT Advanced Water Treatment Pilot Data Review
- Attachment I, SWIFT Research Center: NWRI Panel and Academic Review of UIC Inventory Information Package

Table 3-1 summarizes each Attachment.

1.2.2 Virginia Department of Health Information Request

Additionally, the Virginia Department of Health (VDH) requested detailed information regarding six topics:

1. Injection well construction details and operation plan during test period
2. Monitoring wells (number, location, size, screen depth, estimated construction dates, etc.)
3. Monitoring plan (sampling locations, sample collection method, constituents tested, frequency of sampling, duration of data collection)
4. Soil column testing plan
5. Most recent estimates on time of travel; modeling improvements planned
6. Potential adverse effects and mitigation measures (aquifer “conditioning” to stabilize clays, other?)

An additional purpose of this document is to address VDH’s information request.

1.2.3 Virginia Department of Environmental Quality Request

The Virginia Department of Environmental Quality (DEQ) made a recent request, via conversation, for a bibliography of studies regarding Soil Aquifer Treatment (SAT). This document provides a comprehensive body of scientific investigation on SAT regarding pathogens and organics removal.

EPA-Requested Information

The following subsections address specific information requests.

2.1 Results of Ongoing Pilot Advanced Wastewater Treatment System

HRSD conducted room-scale pilot testing in 2016 of two treatment processes: a Granular Activated Carbon—or “carbon-based”—advanced treatment process and a reverse osmosis (RO)—or “membrane-based”—advanced treatment process. Pilot performance for key constituents during approximately five months of membrane operation and ten months of carbon operation is summarized in Table 2-1 and further detailed in a slide deck provided as Attachment H. The available data demonstrates that both treatment processes can effectively achieve the identified SWIFT Water quality targets (Attachment B). A PAS compatibility analysis showed that due to the high total dissolved solids in the receiving aquifer, the carbon-based effluent is more suitable for recharge; the membrane-based effluent would require significant salt addition to the finished water to achieve PAS compatibility targets. As expected, the removal of total organic carbon (TOC) also differs between the two pilot processes (see Attachment H, slides 42-59 for detailed TOC removal performance). To better understand the potential risk associated with TOC concentrations, HRSD conducted extensive emerging contaminant monitoring, evaluated disinfection byproduct formation potential, and submitted samples for a suite of bioassay testing (refer to Table 2-1 for data on emerging contaminants and bioassay monitoring, disinfection byproduct (DBP) formation potential is documented in Attachment H, slides 83-84). Given the similar performance of both pilot trains with respect to emerging contaminant removal and disinfection byproduct formation potential, the higher TOC concentration present in the pilot effluent from the carbon train does not equate to a higher human health risk. This is further supported by bioassay testing which is designed to detect the potential risk associated with the full suite of contaminants present in a water sample. In the bioassay testing of the pilot effluent samples, neither the carbon nor the membrane train elicited an endocrine or cytotoxic response. Further, the carbon unit will be operated to target a 4 milligrams per liter (mg/L) TOC (monthly average) which is consistent with the Upper Occoquan Service Authority’s indirect potable reuse limit of 10 mg/L chemical oxygen demand (monthly average).

Table 2-1. Comparison of Water Quality Data for Pilot Processes

	Pilot Effluent[1]	
Parameter	**Carbon Train, Low Rate**	**Membrane Train**
Primary maximum contaminant levels (MCLs) (Refer to slide 64 in App H)	No exceedances of MCLs	No exceedances of MCLs
Secondary MCLs (SMCL - Refer to slide 66 in App H)		
Total dissolved solids only SMCL exceeded, 99th percentile	635 mg/L	29 mg/L
Pathogen Indicators (Refer to slides 69-70, 80-81 in App H)		
Total coliform, 95th percentile	<1 Most Probable Number (MPN)/100 milliliters	1 MPN/100 milliliters
E coli, 95th percentile	<1 MPN/100 milliliters	<1 MPN/100 milliliters
MS2 Challenge Test	> 8-log removal	> 8-log removal
Pepper Mild Mottle Virus	>5.9 log removal	>5.9 log removal

Table 2-1. Comparison of Water Quality Data for Pilot Processes

	Pilot Effluent[1]	
Parameter	**Carbon Train, Low Rate**	**Membrane Train**
Total # Quantified Emerging Contaminants (Refer to slides 71-74 in App H)	13	13
Total # Unique Emerging Contaminant Detections[2]	11	7
Bioassays (Refer to slides 75-77 in App H)		
Estrogen Receptor Assay	No response	No response
Glucocorticoid Receptor Assay	No response	No response
Cytotoxicity Assay	No response	No response
P53 Assay	No response	No response
Public Health Indicators (Refer to Slide 67 in App H)		
1,4-dioxane	0.26-0.39 micrograms per liter (µg/L)[3]	<0.07 µg/L[4]
17-β-estradiol	<0.005 µg/L[5]	<0.005 µg/L[6]
DEET	<0.010 µg/L[5]	<0.010-0.012 µg/L[6]
Ethinyl estradiol	<0.005 µg/L[5]	<0.005 µg/L[6]
N-Nitrosodimethylamine (NDMA)	<0.2-2.5 ng/L[7]	<2-7.9 ng/L[8]
Perchlorate	< 4 µg/L[9]	< 4 µg/L[9]
Perfluorooctanoic acid and Perfluorooctane sulfonate (PFOA + PFOS)	<60 ng/L[10]	<60 ng/L[10]
Tris(2-carboxyethyl) phosphine	<0.010 µg/L[5]	<0.010 µg/L[6]
Treatment Efficacy Indicators (Refer to Slide 68 in App H)		
Cotinine	<0.010 µg/L[5]	<0.010 µg/L[6]
Primidone	Range: <0.005 – 0.0052 µg/L[5]	<0.005 µg/L[6]
Phenytoin (Dilantin)	<0.02 µg/L[5]	<0.02 µg/L[6]
Meprobamate	<0.005 µg/L[5]	<0.005 µg/L[6]
Atenolol	<0.005 µg/L[5]	<0.005 µg/L[6]
Carbamazepine	<0.005 µg/L[3]	<0.005 µg/L[4]
Estrone	<0.005 µg/L[3]	<0.005 µg/L[4]
Sucralose	Range: <0.1 - 6.0 µg/L[3]	Range: <0.1 - 0.39 µg/L[4]
Triclosan	<0.010 µg/L[3]	<0.010 µg/L[4]

[1] All items with a "<" were non-detect and noted as < the detection limit. Some parameters, like primidone, had a mixture of detections and non-detections.

[2] Carbon-train detections: Cyanazine, Sucralose, Iohexal, Azithromycin, 4-nonylphenol, Lidocaine, Acesulfame-K, 4-tert-octylphenol, BPA, Linuron, Sulfamethoxazole. Membrane train detections: Cyanazine, Sucralose, DEET, 4-nonylphenol, Butalbital, 4-tert-octylphenol, 2,4-D

[3] Based on 6 samples in pilot effluent.

[4] Based on 1 sample in pilot effluent.

[5] Based on 12 samples in pilot effluent.

[6] Based on 9 samples in pilot effluent.

[7] Based on 2 samples in pilot effluent.

[8] Based on 20 samples in pilot effluent.

[9] Based in 10 samples in pilot feed; only 2 data points available in pilot effluent for carbon (results <4 µg/L).

Table 2-1. Comparison of Water Quality Data for Pilot Processes

	Pilot Effluent[1]	
Parameter	Carbon Train, Low Rate	Membrane Train

[10] Based on 4 samples in pilot feed; not sampling pilot effluent.

2.2 Analysis of the Injected Fluid with the Aquifer Water Quality

This section also addresses VDH request #6, Potential adverse effects and mitigation measures (aquifer "conditioning" to stabilize clays, other?).

An analysis was conducted to evaluate the geochemical compatibility of the native groundwater, aquifer matrix and SWIFT Water. The native groundwater quality and aquifer matrix mineralogy were obtained from samples taken during the installation and testing of the SWIFTRC recharge well; while the recharge water quality was obtained from the Advanced Water Treatment pilot effluent sampling. Table 2-2 presents the geochemical concerns and the approach to evaluating them.

Table 2-2. Summary Geochemical Characterization and Evaluation Approaches

Potential Issue	Media to be Characterized	Evaluation Approaches
Mineral dissolution	(1) Recharge Water/ Groundwater – Aquifer Matrix (2) Recharge Water – Aquifer Matrix	Geochemical modeling of interactions between native groundwater (test well), recharge water (effluent from pilot plants), aquifer matrix (test well)
Mineral precipitation	(1) Recharge Water/ Groundwater – Aquifer Matrix (2) Recharge Water – Aquifer Matrix	Geochemical modeling of interactions between native groundwater (test well), recharge water (effluent from pilot plants), aquifer matrix (test well)
Clay structure fragmentation	Recharge Water – Aquifer Matrix	Classify major cations of the native groundwater (test well), recharge water (effluent from pilot plants), /compare aquifer matrix cation exchange capacity - CEC (test well)
Clay particle dispersion	Recharge Water – Aquifer Matrix	Geochemical modeling of interactions between native groundwater (test well), recharge water (effluent from pilot plants), aquifer matrix (test well)
Physical clogging	Recharge Water	Filtration techniques on recharge water

Geochemical modeling revealed the possibility of mineral dissolution and precipitation from mixing of the recharge water with the aquifer matrix. This potential is mitigated by adjusting pH to maintain a hydrous ferric oxide coating and counter acid formation and dissolution of metals. As well, the ionic strength difference between the recharge water and the native groundwater indicates the potential for clay particle dispersion and structure fragmentation. This can be addressed by pre-treating the aquifer around the well (to approximately a 20-foot radius) with an aluminum chloride solution. Table 2-3 provides the issues identified from the evaluation and the associated mitigation measures.

Table 2-3. Summary of Mitigation Approach

Mitigation Issue	Mitigating Action	Mitigating Objective	Summary Description
Recharge Water/Aquifer Interaction			
Mineral dissolution/ precipitation	Adjust pH with sodium hydroxide	Prevent mobilization of iron and arsenic	Form and maintain hydro ferric oxide (HFO) coating Maintain pH to counter acid formation due to iron oxidation effects
Aquifer Clay Matrix Stability			
Clay Particle dispersion and clay structure fragmentation	Conditioning salt flush using aluminum chloride ($AlCl_3$)	Prevent dispersion and disruption of clay particles and prevent clogging of the aquifer	Tighten the bonds between clay particles Tighten the bonds within the clay structures

A detailed evaluation of the geochemical analysis can be found in Attachment D, *Geochemical Evaluation and Framework Development for the Sustainable Water Initiative for Tomorrow Proposed Managed Aquifer Recharge Program*.

To evaluate the effectiveness of the aquifer pre-conditioning procedure, an aluminum chloride treatment was piloted in MW-LPA, a monitoring well screening the Lower Potomac Aquifer. The pilot treatment event (starting 10/24/17) employed a 0.1 molar $AlCl_3$ solution and conditioned an aquifer volume extending an estimated 20 feet from the well. In a post-treatment step drawdown test, the pumping specific capacity at MW-LPA improved by 20 percent. More important, the hydraulic characteristics of MW-LPA remained stable during a 7-day injection test conducted after the treatment.

Had the treatment been a failure, the injection capacity of MW-LPA would have declined precipitously within several hours of starting the test similar to what was seen at the pilot injection well at Moore's Bridges Water Treatment Plant in Norfolk, VA. This pilot operation was conducted by the U.S. Geological Survey and is described in greater detail in Attachment D, *Geochemical Evaluation and Framework Development for SWIFT.* The volume of potable water used during the post treatment recharge test far exceeded the volume of $AlCl_3$ injected (extending beyond the 20-foot treated radius). Thus, potable water migrated outside the treated zone around MW-LPA without showing signs of clay degradation and clogging. The testing also confirmed the viability of a 20-foot treatment zone. Appendix A of Attachment C, *SWIFTRC Aquifer Monitoring and Contingency Plan for Managed Aquifer Recharge*, contains a detailed Standard Operating Procedure for pre-conditioning the aquifer with aluminum chloride.

2.3 Construction Details of the Pilot Recharge Well

This section also addresses VDH request # 1, Injection well construction details, and operation plan during test period.

To obtain native groundwater, aquifer formation samples and hydraulic data from the PAS, HRSD installed, developed, and tested a pilot recharge well (SWIFTRC MAR well, TW-1) at their Nansemond Wastewater Treatment Plant between April and September 2016. The well boring was drilled to 1,410 feet below grade, fully penetrating the Upper and Middle Zones of the Potomac Aquifer, and penetrating through the upper portion of the Lower zone of the aquifer (LPA). With the exception of several thinner sand intervals that were not screened, 11 stainless steel screens in TW 1 fully penetrated the Upper Zone of the Potomac Aquifer and Middle Zone of the Potomac Aquifer, and the upper portion of the LPA. Figure 2-1 provides complete construction details for TW-1.

Detailed information regarding the construction of TW-1 can be found in Attachment D *Geochemical Evaluation and Framework Development for the Sustainable Water Initiative for Tomorrow Proposed Managed Aquifer Recharge Program*, Section 4.

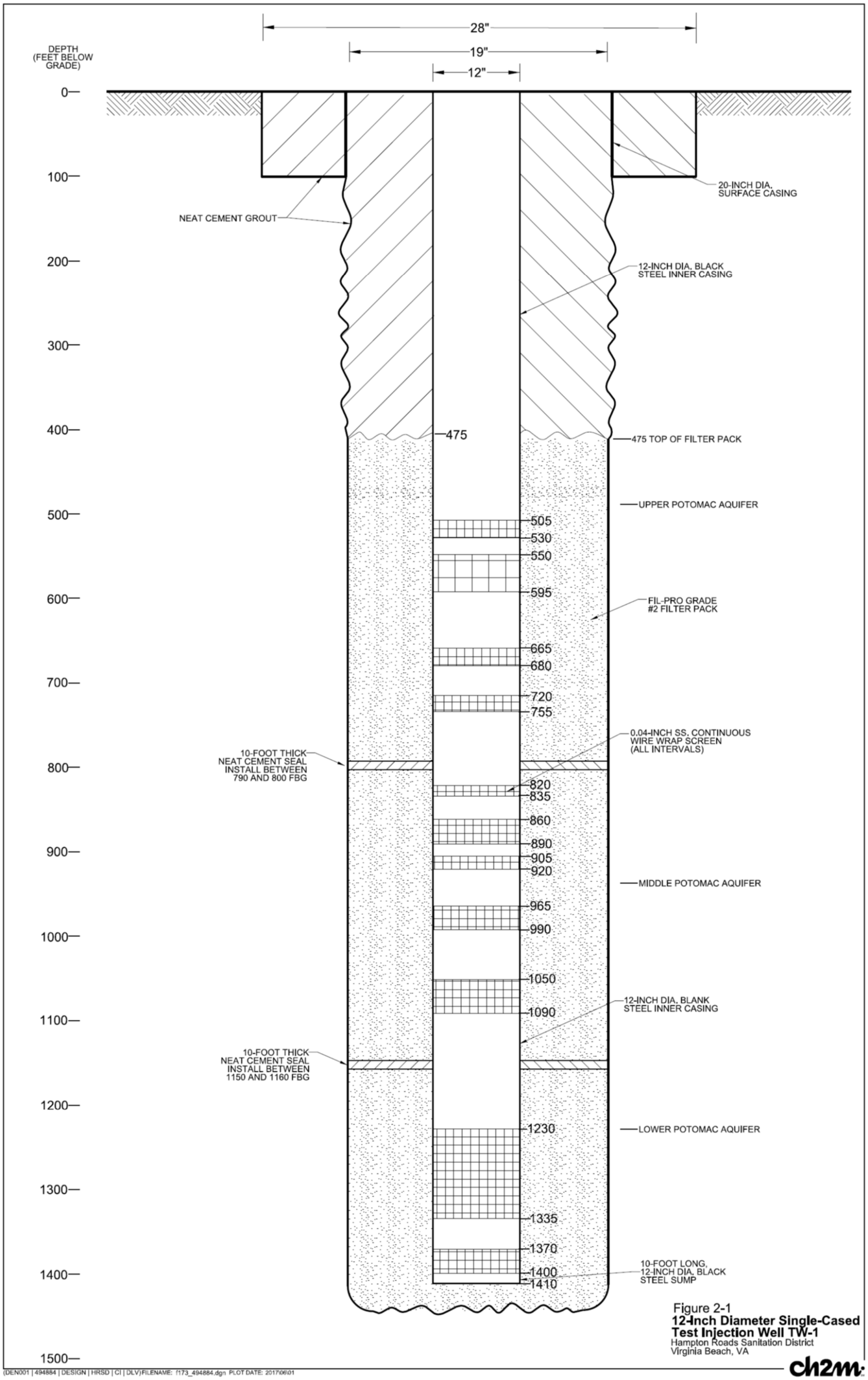

Figure 2-1. Well Construction Diagram

2.4 Complete Sampling and Analysis and Reporting Plan and Description of the Monitoring Well Network

This section also addresses VDH requests # 2, Monitoring wells (number, location, size, screen depth, estimated construction dates, etc.); # 3, Monitoring plan (sampling locations, sample collection method, constituents tested, frequency of sampling, duration of data collection); #4, Soil Column Testing and; #5, Most recent estimates on time of travel; modeling improvements planned using the monitoring well data to refine estimates on time of travel. DEQ's request for an SAT bibliography is also addressed.

Attachments B and C, *SWIFTRC SWIFT Water Quality Targets* and *SWIFTRC Aquifer Monitoring and Contingency Plan for Managed Aquifer Recharge*, respectively, prescribe the comprehensive monitoring, sampling, analysis and reporting plans for the entire SWIFTRC. These plans include information on sampling locations, parameters, frequency, analysis methods, general procedures and reporting. Regulatory endpoints were developed in collaboration with VDH and DEQ.

In addition, Attachment G, *Hazard Analysis and Critical Control Points* (HACCP) provides details regarding the monitoring that will be conducted through the Advanced Water Treatment to safeguard public health and the health of the Potomac Aquifer System. The HACCP plan is designed to prevent the use of off-spec water for aquifer recharge.

Attachment E, *Plan for Evaluating Soil Aquifer Treatment (SAT) for SWIFT*, describes previous investigations of SAT and addresses bench-scale and field-scale evaluations of SAT that HRSD will conduct with respect to the Potomac Aquifer.

Travel time to the first monitoring well, MW-SAT, located approximately 50 feet from the recharge well will be relatively rapid, within the first week of recharge activities. It is important to note however, that the velocity of the recharge water flowing through the aquifer will decrease with increasing distance from the recharge well. For example, recharge water is not expected to reach the remaining monitoring wells, approximately 400 – 500 feet from the recharge well, until approximately 100 days after recharging. As the recharge front moves through the aquifer it will be observed in the monitoring well network. These data will be used to refine modeling used to project travel times/distances beyond the modeling network with greater accuracy. This is further detailed in Attachments C, section 2.3.2 and Attachment E throughout the document.

2.5 Comprehensive Assessment of Any Potential for the Pilot Aquifer Recharge Well to Adversely Impact Underground Sources of Drinking Water

HRSD has approached SWIFT implementation in a cautious, phased manner, involving numerous stakeholders, including key individuals from the Virginia Department of Environmental Quality and the Virginia Department of Health. The process began with an initial study exploring the feasibility of achieving potable water standards through advanced treatment and using the SWIFT Water to replenish depleting groundwater supplies within the PAS. The positive results from this evaluation triggered a more detailed analysis of treatment processes and aquifer characteristics.

2.5.1 Piloting Advanced Water Treatment Processes

Based on the information learned in the first phase, HRSD initiated the piloting of two proven process trains at its York River Treatment Facility. The data generated from this work demonstrates clearly that the effluent from both pilot trains meets EPA's primary drinking water standards. Moving beyond primary MCLs and considering other parameters that may become of concern in the future, the two trains were comparable in terms of emerging contaminant removal and disinfection byproduct formation potential, and in bioassay testing of the pilot effluent, neither of the trains elicited an endocrine or cytotoxic response. Furthermore, both trains provide similar quantifiable log removal credit for viruses, *Cryptosporidium*, and *Giardia*, and demonstrated complete removal of MS2 coliphage (>8 log removal) in challenge testing.

2.5.2 Geochemical Compatibility Evaluation

In addition to ensuring that the SWIFT Water quality can meet potable water standards, it is also important to ensure geochemical compatibility with the PAS. Appropriately matching geochemistry is critical for preventing the mobilization of minerals (e.g., arsenic) within the PAS that could pose potential risk for the drinking water source. The second phase of SWIFT implementation, therefore, involved a more detailed review of the geochemical conditions within the PAS at the site of the future SWIFTRC. Comparison of the site-specific geochemical conditions to the effluent quality of the pilot process trains indicates that the effluent quality of the carbon-based process is compatible with the chemistry of the PAS.

2.5.3 Hazard Analysis and Critical Control Points

In evaluating SWIFT Water quality with respect to human health considerations and aquifer compatibility, HRSD selected the carbon-based treatment process for use in the SWIFTRC. As an additional measure for the mitigation of human health risk, HRSD will be employing HACCP methods in operational management of the SWIFTRC advanced water treatment and groundwater recharge process. HACCP has been applied to a number of water recycling (including water reuse) projects to demonstrate the management of microbiological and chemical risks through a multiple barrier approach. The risk-based approach to water treatment has been widely adopted to illustrate to regulators that risks associated with recycled water have been fully considered and addressed.

2.5.4 SWIFT Monitoring Program and Independent Oversight

Several measures are planned to provide continued assurances on the operation and performance of the SWIFT advanced treatment facilities and protection of the aquifer. Chief among these is a rigorous aquifer monitoring protocol that will provide early detection of any potential issues that may adversely impact the drinking water source and contingency plans should any issues be identified. In addition, HRSD has been working with state and local stakeholders in the development of an independent oversight structure for the SWIFT initiative in conjunction with the UIC permit. A bill seeking legislative authorization for this oversight group has been introduced for consideration in the 2018 Virginia General Assembly session. All agencies involved, including HRSD, have the common goal of ensuring the long-term protection and availability of the aquifer as a public water supply.

Attachment Summary

Table 3-1 provides a summary of the attachments to this document and which information requests they address.

Table 3-1. Attachment Summary

Attachment Title	Summary	Specific request(s) addressed
A – Information Requests (EPA, VDH)	Correspondence from EPA and VDH identifying the information requested above	N/A
B – SWIFT Research Center SWIFT Water Quality Targets	Defines the SWIFT water quality targets for the SWIFTRC and demonstrates how the targets will be achieved	EPA - “a complete sampling and analysis and reporting plan” EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water” VDH – 3. Monitoring plan
C – SWIFT Research Center Aquifer Monitoring and Contingency Plans for Managed Aquifer Recharge	Describes the monitoring and contingency plans for evaluating the hydraulic and water quality response of the PAS and to establish a guideline for conducting a field scale soil aquifer treatment (SAT) study	EPA - “a complete sampling and analysis and reporting plan” EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water” VDH – 2. Monitoring wells (number, location, size, screen depth, estimated construction dates, etc.) VDH – 3. Monitoring plan (sampling locations, sample collection method, constituents tested, frequency of sampling, duration of data collection) VDH - 5. Most recent estimates on time of travel; modelling improvements planned VDH - 6. Potential adverse effects and mitigation measures (aquifer “conditioning” to stabilize clays, other?)
D – Geochemical Evaluation and Framework Development for the SWIFT Proposed Managed Aquifer Recharge Program	Describes the evaluation, results and mitigation strategy of the geochemical compatibility of the recharge water with the native groundwater and aquifer material.	EPA - “an analysis of the injected fluid with the aquifer water quality” EPA - “construction details of the pilot recharge well” VDH – 1. Injection well construction details and operation plan during test period VDH – 6 Potential adverse effects and mitigation measures (aquifer “conditioning” to stabilize clays, other?)
E – Plan for Evaluating SWIFT Soil Aquifer Treatment	Characterizes soil aquifer treatment (SAT) through column testing experiments simulating MAR operations, and describes field scale studies during the operations	EPA - “results of ongoing pilot advanced wastewater treatment system” EPA - “a description of the monitoring well network” EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water” VDH – Soil column testing plan DEQ – Request for SAT bibliography
F – SWIFT Research Center 100% Design Documentation		EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water”

Table 3-1. Attachment Summary

Attachment Title	Summary	Specific request(s) addressed
G – SWIFT Research Center HACCP Memo	Summarizes the HACCP review of the SWIFTRC advanced water treatment and groundwater recharge process. Also provides a basis for future updates of the HACCP water quality risk assessment as the intent is to keep it as a “living document” that can be modified as new treatment techniques, finished water quality goals, or risks are identified during the program.	EPA - “a complete sampling and analysis and reporting plan” EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water” VDH – 3. Monitoring plan (sampling locations, sample collection method, constituents tested, frequency of sampling, duration of data collection)
H – SWIFT Advanced Water Treatment Pilot Data Review	Summarizes the pilot effluent quality and operational data for the carbon and membrane pilot trains	EPA - “results of ongoing pilot advanced wastewater treatment system” EPA - “a comprehensive assessment of any potential for the pilot aquifer recharge well to adversely impact underground sources of drinking water”
I - SWIFT Research Center: NWRI Panel and Academic Review of UIC Inventory Information Package	The UIC submittal package has had been reviewed by regulatory agencies, NWRI Panel and independent 3rd party reviewers (University Professors). This attachment contains those comments and HRSD’s responses	Some specific VDH comments are addressed. Others are various comments from the reviewers.